

Appl. No. 10/652,007
Amendment dated May 20, 2005
Reply to Office Action of February 23, 2005

REMARKS/ARGUMENTS

Claim 37 has been amended; claims 36 and 38 have been cancelled, and new claims 50 and 51 have been added. Claims 37, 39, and 41-51 now remain in the case.

Support for Amended and New Claims

Support for the amended and new claims is as follows:

Amended Claim 37	Claims 36, 37, and 50
New Claim 50	Page 22, lines 9-11 and dependent claim 38
New Claim 51	Page 22, lines 9-11 and dependent claim 38

Priority

On pages 2 and 3 of the Office Action mailed 02/23/2005, the USPTO recites procedures which must be followed if priority to a previously filed application is desired. Applicants, in their Preliminary Amendment dated August 29, 2003, which was filed with this divisional application, amended the instant application on page 2, lines 5-7, to recite that the instant application was a divisional application of U.S. Application Serial No. 09/792, 691, filed February 23, 2001. This information has been updated in the current amendment.

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

Specification

The disclosure was objected to because of the following informalities: The specification must be amended to include the Serial Nos. or U.S. Patent Nos. of the related applications. These amendments to the specification were carried out in the Preliminary Amendment dated August 29, 2003, and such information has been further updated in this amendment.

Section 112 Rejections

Claims 36-49 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

The rejection states that the terminology "low dielectric constant" is considered to be relative terminology and therefore the meets and bounds of the claims cannot be determined. It is not clear what dielectric constants are encompassed by the claims, therefore, the claims were considered indefinite.

In Applicants' specification, on page 6, lines 20-23, Applicants define the objected to terminology as follows:

"By use of the interchangeable terms "low k" or "low dielectric constant" herein is meant a dielectric constant below the dielectric constant of silicon oxide or silicon nitride. Preferably, a low dielectric constant is a dielectric constant below about 3.5, and more preferably below about 3".

Appl. No. 10/652,007
Amendment dated May 20, 2005
Reply to Office Action of February 23, 2005

In view of this definition found in the Applicants' specification of the term "low dielectric constant", it is believed that Applicants' claim language is sufficiently clear to particularly to permit one skilled in the art to which the subject matter pertains to determine the meets and bounds of the claims.

Section 102/103 Rejections

1. Rejection of Claims 36-49 over Musaka et al. U.S. Patent 5,571,571

Claims 36-49 were rejected under as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Musaka et al. U.S. Patent 5,571,571. The Musaka et al. patent teaches a method of forming conformal, high quality silicon oxide films that can be deposited over closely spaced, submicron lines and spaces without the formation of voids, comprises forming a plasma of TEOS and a selected halogen-containing gas in certain ratios. By proper control of the energy sources that create the plasma, the proper selection of the halogen-containing gas and selection of other processing parameters, high deposition rates can also be achieved.

The Office Action states that the document teaches silicon oxide containing materials including carbon and fluorine. The Office Action then cites In re Thorpe, 227 USPQ 964, at 966, stating, "The patentability of a product does not depend upon its method of production. If the product in [a] product-by-process claim is the same or obvious from a product of the prior art; [then] the claim is unpatentable even though the prior [art] product was made by a different process."

The Office Action then cites In re Marosi as stating that "...once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product."

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

It is Applicants' position that the PTO has not carried out the first part of the *In re Marosi* requirement; i.e., the PTO has not provided *a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art*. Merely stating that the reference teaches "...silicon oxide containing materials including carbon and fluorine." provides no rationale which would tend to show that the product of the reference is the same as the claimed product.

To the contrary, no attempt was made by the PTO to explain where the cited Musaka et al. reference teaches or suggests Applicants' *claimed* product, i.e., where Musaka et al. shows or suggests the presence of each of the bonds recited in Applicants' claims.

2. Rejection of Claims 36-49 over Qian et al. U.S. Patent 5,571,576.

Claims 36-49 were rejected under as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Qian et al. U.S. Patent 5,571,576. Qian et al. U.S. Patent 5,571,576 describes a method of forming a fluorinated silicon oxide dielectric layer by plasma chemical vapor deposition. The method includes the steps of creating a plasma in a plasma chamber and introducing a silicon-containing gas, a fluorine-containing gas, oxygen, and an inert gas such that the gases are excited by the plasma and react proximate a substrate to form a fluorinated silicon oxide layer on the surface of the substrate. The fluorinated layer formed has a dielectric constant which is less than that of a silicon oxide layer.

The Office Action states that the document teaches silicon oxide containing materials including carbon and fluorine. The Office Action then cites *In re Thorpe*, 227 USPQ 964, at 966, stating, "The patentability of a product does not depend upon its method of production. If the product in [a] product-by-process claim is the same or obvious from a product of the prior art, [then] the claim is unpatentable even though the prior [art] product was made by a different process."

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

The Office Action then cites *In re Marosi* as stating that "...once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product."

It is Applicants' position that the PTO has not carried out the first part of the *In re Marosi* requirement; i.e., the PTO has not provided a *rationale tending to show that the claimed product appears to be the same or similar to that of the prior art*. Merely stating that the reference teaches "...silicon oxide containing materials including carbon and fluorine." provides no rationale which would tend to show that the product of the reference is the same as the claimed product.

To the contrary, no attempt was made by the PTO to explain where the cited Qian et al. reference teaches or suggests Applicants' *claimed* product, i.e., where Qian et al. shows or suggests the presence of each of the bonds recited in Applicants' claims.

3. Rejection of Claims 36-49 over Matsuzawa U.S. Patent 6,000,339

Claims 36-49 were rejected under as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Matsuzawa U.S. Patent 6,000,339. Matsuzawa discloses a material for forming silica-base coated insulation films used to form interlayer insulation films of multi-layer interconnections in VLSI. A material for forming a silica-base coated insulation film, obtained from (a) an alkoxysilane and/or a partially hydrolyzed product thereof, (b) a fluorine-containing alkoxysilane and/or (c) an alkoxide of a metal other than Si and/or a derivative thereof and (d) an organic solvent. The material for forming silica-base coated insulation films according to the present invention has a storage stability and also enables thick-layer formation.

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

Silica-base insulation films obtained are transparent and uniform films and are those in which no defects, such as cracks or pinholes are seen, also having a superior oxygen plasma resistance.

The Office Action states that the document teaches silicon oxide containing materials including carbon and fluorine. The Office Action then cites *In re Thorpe*, 227 USPQ 964, at 966, stating, "The patentability of a product does not depend upon its method of production. If the product in [a] product-by-process claim is the same or obvious from a product of the prior art, [then] the claim is unpatentable even though the prior [art] product was made by a different process."

The Office Action then cites *In re Marosi* as stating that "...once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product".

It is Applicants' position that the PTO has not carried out the first part of the *In re Marosi* requirement; i.e., the PTO has not provided *a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art*. Merely stating that the reference teaches "...silicon oxide containing materials including carbon and fluorine." provides no rationale which would tend to show that the product of the reference is the same as the claimed product.

To the contrary, no attempt was made by the PTO to explain where the cited Matsuzawa et al. reference teaches or suggests Applicants' *claimed* product, i.e., where Matsuzawa et al. shows or suggests the presence of each of the bonds recited in Applicants' claims.

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

4. Rejection of Claims 36-49 over European Patent Application 0 517 548

Claims 36-49 were rejected under as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over European Patent Application 0 517 548. European Patent Application 0 517 548 describes a chemical vapor deposition method for forming a fluorine-containing silicon oxide film comprising introducing a gaseous mixture of alkoxysilane or its polymers as a source gas with fluoroalkoxysilane added thereto into a reaction chamber and performing decomposition of the gaseous mixture to deposit the fluorine-containing silicon oxide film onto a substrate. During the formation of the fluorine-containing silicon oxide film, at least one of compounds containing phosphorus or boron, such as organic phosphorus compounds and organic boron compounds may be evaporated and introduced into said gaseous mixture, thereby adding at least one of phosphorus and boron to said fluorine-containing silicon oxide film. The fluorine-containing oxide film may be formed by affecting the decomposition of the gaseous mixture in the presence of ozone gas, or under ultraviolet radiation, or gas plasma.

The Office Action states that the document teaches silicon oxide containing materials including carbon and fluorine. The Office Action then cites *In re Thorpe*, 227 USPQ 964, at 966, stating, "The patentability of a product does not depend upon its method of production. If the product in [a] product-by-process claim is the same or obvious from a product of the prior art, [then] the claim is unpatentable even though the prior [art] product was made by a different process."

The Office Action then cites *In re Marosi* as stating that "...once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product".

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

It is Applicants' position that the PTO has not carried out the first part of the In re Marosi requirement; i.e., the PTO has not provided *a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art*. Merely stating that the reference teaches "...silicon oxide containing materials including carbon and fluorine." provides no rationale which would tend to show that the product of the reference is the same as the claimed product.

To the contrary, no attempt was made by the PTO to explain where the cited European Patent Application 0 517 548 reference teaches or suggests Applicants' *claimed* product, i.e., where European Patent Application 0 517 548 shows or suggests the presence of each of the bonds recited in Applicants' claims.

5. Rejection of claims 36-49 over Japanese Document 09-008031

Claims 36-49 were rejected as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Japanese Document 09-008031. Japanese Document 09-008031 (9-8031) describes forming a so-called low dielectric coefficient film having high embedding ability and a low dielectric coefficient by using material gas including at least methylfluorosilane and water or methylfluorosilane and hydrogen peroxide. Material gas to be used for chemical vapor phase (CVD) epitaxy should include at least methylfluorosilane and water or methylfluorosilane and hydrogen peroxide. For example, a plurality of interconnections are formed on a substrate, and then a protection film is formed by means of plasma CVD to cover the respective interconnections. Then material gas, being a mixture of $\text{Si}(\text{CH}_3)_2\text{F}_2$, $\text{Si}(\text{CH}_3)\text{F}_3$, and H_2O , is introduced to a low pressure CVD apparatus to form an insulation film of silicon oxide on the protection film. Then, after a silicon oxide film is formed by means of CVD as another insulation film on an upper face of the insulation film, annealing is performed to remove moisture in the insulation film.

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

The Office Action states that the document teaches silicon oxide containing materials including carbon and fluorine. The Office Action then cites *In re Thorpe*, 227 USPQ 964, at 966, stating, "The patentability of a product does not depend upon its method of production. If the product in [a] product-by-process claim is the same or obvious from a product of the prior art, [then] the claim is unpatentable even though the prior [art] product was made by a different process."

The Office Action then cites *In re Marosi* as stating that "...once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product".

It is Applicants' position that the PTO has not carried out the first part of the *In re Marosi* requirement; i.e., the PTO has not provided *a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art*. Merely stating that the reference teaches "...silicon oxide containing materials including carbon and fluorine." provides no rationale which would tend to show that the product of the reference is the same as the claimed product.

To the contrary, no attempt was made by the PTO to explain where the cited Japanese Document 09-008031 teaches or suggests Applicants' *claimed* product, i.e., where Japanese Document 09-008031 shows or suggests the presence of each of the bonds recited in Applicants' claims.

6. Rejection of Claims 36-49 over Japanese Document 08-21870

Claims 36-49 were rejected over Japanese Document 08-21870. The Japanese Document 08-21870 discloses sharply reducing the water content of a good quality fluorine-containing silicon oxide film having a high fluorine content and low permittivity in spite of low temperature formation. In a

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

method for producing a fluorine-containing silicon oxide film on a substrate by the chemical vapor growth method, the method for producing a fluorine-containing silicon oxide film is characterized in the fluoroalkoxysilane is added to a gaseous starting material consisting of trialkoxysilane and oxidizing gas. Because of high film forming velocity, a fluorine-containing silicon oxide film is obtained on a substrate with high productivity.

The Office Action states that the document teaches silicon oxide containing materials including carbon and fluorine. The Office Action then cites *In re Thorpe*, 227 USPQ 964, at 966, stating, "The patentability of a product does not depend upon its method of production. If the product in [a] product-by-process claim is the same or obvious from a product of the prior art, [then] the claim is unpatentable even though the prior [art] product was made by a different process."

The Office Action then cites *In re Marosi* as stating that "...once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product".

It is Applicants' position that the PTO has not carried out the first part of the *In re Marosi* requirement; i.e., the PTO has not provided *a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art*. Merely stating that the reference teaches "...silicon oxide containing materials including carbon and fluorine." provides no rationale which would tend to show that the product of the reference is the same as the claimed product.

To the contrary, no attempt was made by the PTO to explain where the cited Japanese Document 08-21870 reference teaches or suggests Applicants' *claimed* product, i.e., where Japanese Document 08-21870 shows or suggests the presence of each of the bonds recited in Applicants' claims.

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

7. Rejection of Claims 36-49 over Lee et al. U.S. Patent 6,043,167

Claims 36-49 were rejected over Lee et al. U.S. Patent 6,043,167. The Lee et al. patent teaches a method for forming an insulating film having a low dielectric constant, which is suitable for intermetal insulating film applications, by plasma enhanced chemical vapor deposition (PECVD), includes the step of supplying a first source gas containing fluorine and carbon to a dual-frequency, high density plasma reactor. The method also includes the step of supplying a second source gas containing silicon dioxide to the reactor. In this manner a fluorocarbon/silicon dioxide film is formed on a substrate in the reactor.

The Office Action states that the document teaches silicon oxide containing materials including carbon and fluorine. The Office Action then cites In re Thorpe, 227 USPQ 964, at 966, stating, "The patentability of a product does not depend upon its method of production. If the product in [a] product-by-process claim is the same or obvious from a product of the prior art, [then] the claim is unpatentable even though the prior [art] product was made by a different process."

The Office Action then cites In re Marosi as stating that "...once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product".

It is Applicants' position that the PTO has not carried out the first part of the In re Marosi requirement; i.e., the PTO has not provided *a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art*. Merely stating that the reference teaches "...silicon oxide containing materials including carbon and fluorine." provides no rationale which would tend to show that the product of the reference is the same as the claimed product.

Appl. No. 10/652,007

Amendment dated May 20, 2005

Reply to Office Action of February 23, 2005

To the contrary, no attempt was made by the PTO to explain where the cited Lee et al. reference teaches or suggests Applicants' *claimed* product, i.e., where Lee et al. shows or suggests the presence of each of the bonds recited in Applicants' claims.

8. Rejection of Claims 36-49 over Moghadam et al. U.S. Patent 6,413,583

Claims 36-49 were rejected under 35 U.S.C. 102(a or e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Moghadam et al. U.S. Patent 6,413,583.

Moghadam et al. U.S. Patent 5,571,571 describes a method for depositing silicon oxide layers having a low dielectric constant by reaction of an organosilicon compound and a hydroxyl forming compound at a substrate temperature less than about 400°C. The low dielectric constant films contain residual carbon and are useful for gap fill layers, pre-metal dielectric layers, inter-metal dielectric layers, and shallow trench isolation dielectric layers in sub-micron devices. The hydroxyl compound can be prepared prior to deposition from water or an organic compound. The silicon oxide layers are preferably deposited at a substrate temperature less than about 40°C onto a liner layer produced from the organosilicon compound to provide gap fill layers having a dielectric constant less than about 3.0.

The Office Action states that the document teaches silicon oxide containing materials including carbon and fluorine. The Office Action then cites In re Thorpe, 227 USPQ 964, at 966, stating, "The patentability of a product does not depend upon its method of production. If the product in [a] claim is the same or obvious from a product of the prior art, [then] the claim is unpatentable even though the prior [art] product was made by a different process."

The Office Action then cites In re Marosi as stating that "...once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art,

-19-

-20-

Appl. No. 10/652,007
Amendment dated May 20, 2005
Reply to Office Action of February 23, 2005

although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product”.

It is Applicants' position that the PTO has not carried out the first part of the In re In re Marosi requirement; i.e., the PTO has not provided *a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art*. Merely stating that the reference teaches “*..silicon oxide containing materials including carbon and fluorine*.” provides no rationale which would tend to show that the product of the reference is the same as the claimed product.

To the contrary, no attempt was made by the PTO to explain where the cited Moghadam et al. reference teaches or suggests Applicants' *claimed* product, i.e., where Moghadam et al. shows or suggests the presence of each of the bonds recited in Applicants' claims.

9. Rejection of Claims 36-49 over Yieh et al. U.S. Patent 6,121,164

Claims 36-49 were rejected under 35 U.S.C. 102(a or e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Yieh et al. U.S. Patent 6,121,164, each taken alone.

Yieh et al. U.S. Patent 6,121,164 discloses a method and apparatus for forming a halogen-doped silicon oxide film, preferably a fluorinated silicon glass (FSG) film, having compressive stress less than about -5×10^8 dynes/cm². In a specific embodiment, the FSG film is formed by a sub-atmospheric CVD thermal process at a pressure of between about 60-650 torr. The relatively thin film, besides having a low dielectric constant and good gap fill capability, has low compressive stress, and is particularly suitable for use as an intermetal (IMD) layer.

Appl. No. 10/652,007
Amendment dated May 20, 2005
Reply to Office Action of February 23, 2005

The Office Action states that the document teaches silicon oxide containing materials including carbon and fluorine. The Office Action then cites *In re Thorpe*, 227 USPQ 964, at 966, stating, "The patentability of a product does not depend upon its method of production. If the product in [a] product-by-process claim is the same or obvious from a product of the prior art, [then] the claim is unpatentable even though the prior [art] product was made by a different process."

The Office Action then cites *In re Marosi* as stating that "...once the examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward.

It is Applicants' position that the PTO has not carried out the first part of the *In re Marosi* requirement; i.e., the PTO has not provided *a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art*. Merely stating that the reference teaches "...silicon oxide containing materials including carbon and fluorine." provides no rationale which would tend to show that the product of the reference is the same as the claimed product.

To the contrary, no attempt was made by the PTO to explain where the cited *Yieh et al.* reference teaches or suggests Applicants' *claimed* product, i.e., where *Yieh et al.* shows or suggests the presence of each of the bonds recited in Applicants' claims.

Appl. No. 10/652,007
Amendment dated May 20, 2005
Reply to Office Action of February 23, 2005

Claims 36-49 rejected under 35 U.S.C. 102(e) as being anticipated by commonly owned Sukharev et al. U.S. Patent 6,365,528.

The Affidavit of Common Ownership, which accompanies this response, indicates that the inventors in Sukharev et al. U.S. Patent 6,365,528 were, at the time the invention claimed therein was made, under an employment contract to assign any and all rights to such inventions to their employer, LSI Logic Corporation; and that the inventors in Aronowitz et al. divisional Patent Application No. 10,652,007 also were, at the time the invention claimed therein was made, under an employment contract to assign any and all rights to such inventions to their employer, LSI Logic Corporation. This affidavit should remove Sukharev et al. U.S. Patent 6,365,528 as a reference against the claims of the instant divisional application.


SUMMARY

Thus, although nine references were applied against Applicants' claims with the single statement that the reference teaches "...silicon oxide containing materials including carbon and fluorine", the PTO makes no attempt to specifically point out where any of the nine references specifically teach or suggest the subject matter which Applicants' claim as their invention. Therefore, Applicants' claims, as they now stand, should be all patentable over the cited art.

Appl. No. 10/652,007
Amendment dated May 20, 2005
Reply to Office Action of February 23, 2005

If the Examiner in charge of this case feels that there are any remaining unresolved issues in this case, the Examiner is urged to call the undersigned attorney at the below listed telephone number which is in the Pacific Coast Time Zone.

Respectfully submitted,


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